**Gas Law Assignment**

(Note: for these questions, you must remember the conversion between units of volume

1 dm3 = 1 L)

1. Sassy Sarah’s silver sphere is subjected to a pressure of 90.3 kPa at a temperature of 2.00 °C. What will the new sphere pressure be if the temperature drops to a frigid –35.0°C?

*Convert from Celsius to Kelvin*

*Tk = Tc + 273.15*

*Tc = 2 °C*

*T1 = 2.00 °C + 273.15*

*T1 = 275.15 °K*

*T2 = -35.0°C + 273.15*

*T2 = 238.15 °K*

*Relation of pressure uses the following formula:*

*P1/T1 = P2/T2*

*90.3 kPa / 2.00 °C = X/238.15 °K*

*275.15 °K \* X = 238.15 °K \* 90.3 °K*

*X = 238.15 °K \* 90.3K / 275.15 °K*

*X = 78.16 kPa*

*Therefore the new pressure will be 78.16 kPA*

*(3 marks, knowledge)*

to

1. Raman ran when he heard the pop of his prized perfect purple balloon. Fortunately, Raman found that the prized 350 cm3 balloon was still secure in its 19.0 °C container. Just to be on the safe side Raman increased the temperature inside the container to a more comfortable balloon temperature of 41.0°C. Raman didn’t want the balloon to get cold. What is the final volume of Raman’s balloon?

*Use the formula*

*V1 / T1 = V2 / T2*

*Convert from Celsius to Kelvin*

*Tk = Tc + 273.15*

*T1 = 19.0 °C + 273.15*

*T1 = 292.15 K*

*T2 = 41°C + 273.15*

*T2 = 314.15 K*

*Convert from cm*3 to L

*1 L = 0.0001 cm3*

*350 cm3 = 0.350 L*

*V1/T1 = V2/T2*

*0.350 L / 292.15 K = V2/314.15 K*

*V2 = 0.376 L*

*Therefore the final volume of the balloon is 0.376 L*

*(3 marks, knowledge)*

1. Crafty Khurram took Raman’s prized perfect purple balloon to conduct some most unsavoury experiments. Khurram wanted to see if the balloon really did obey Boyle’s Law. When Khurram took the balloon it was a full 375 cm3 at standard pressure. Khurram increased the pressure to 995 kPa. What was the final volume of the balloon?

*Boyle’s law = P1V1 = P2V2*

*Convert from cm3 to L*

*1 L = 0.0001 cm3*

*375 cm3 = 0.375 L*

*Standard pressure = 101.3 kPa*

*(101.3 kPa) (0.375 L) = 995 kPa V2*

*V2 = 0.0382 L*

*Therefore the final volume was 0.0382 L.*

*(2 marks, knowledge)*

1. Daniel popped Raman’s balloon (it accidentally became impailed on a nail). Daniel promised to buy Raman a new balloon if he can answer the following question. If sassy Sarah’s silver sphere is originally at 10°C, what will be the final temperature of the ssssphere if the internal pressure is halved?

*Convert from Celsius to Kelvin:*

*Tk = Tc + 273.15*

*Tk = 10 + 273.15*

*Tk = 283.15*

*Relation of temperature and pressure uses the following formula:*

*P1/T1 = P2/T2*

*From Question #1 we know that the pressure at 238.15 K is 78.16 kPA*

*Therefore the pressure at 10* °*C is*

*P1/T1 = P2/T2*

*78.16 kPa/238.15 K = P2 / 283.15 K*

*P2 = 92.93 kPa*

*Now half that pressure:*

*92.93/2 = 46.47 kPa*

*Use the same formula:*

*P1/T1 = P2/T2*

*92.93 kPa/283.15 K = 46.47 kPa/T2*

*T2 = 141.59 K*

*Therefore the internal temperature is 141.59 K.*

*(2 marks, application, 3 marks, knowledge)*

1. Balloons are everywhere. A 95.0°C bright blue balloon has a volume of 122cm3. What volume will the bbballon occupy at -15°C?

*Using the formula:*

*V1 / T1 = V2 / T2*

*Convert from cm to L*

*122 cm = 0.122 L*

*Convert from Celsius to Kelvin*

*T1 = 95 °C + 273.15*

*T1 = 368.15*

*T2 = -15 °C + 273.15*

*T2 = 258.15 K*

*0.122 L / 368.15 K = V2 / 258.15 K*

*V2 = 0.0855 L*

*Therefore the final volume is 0.0855 L*

*(4 marks, knowledge)*

1. Claire’s compressed cylinder of awesome oxygen has a volume of 30.0 L and pressure of 1740 kPa at 27°C. Claire wonders wildly about the weather. What is the temperature of the aoxygen if curious Claire releases it into a 500.0 L weather balloon at 100.6 kPa?

*Use the Combined Gas law equation*

*P1 V1/T1 = P2V2/T2*

*Convert from Celsius to Kelvin:*

*T1 = Tc + 273.15*

*T1 = 27 + 273.15*

*T1 = 300.15*

*1740 kPa \* 30 L / 300.15 = 100.6 kPa \* 500.0 L / T2*

*T2 = 289.23 K*

*Therefore the final temperature is 289.23 K*

*(2 marks, knowledge)*

1. Emil is impressed with Claire’s wile weather balloon. Emil emails Claire that he would like to send his own emissary into the atmosphere. Claire couriers him a stunning, shiny silver weather balloon with a volume of 500.0 L and tells him to release the ssswballoon into the atmosphere when the temperature is 16°C and the pressure is 100.6 kPa. After 40 minutes, the ssswballoon has risen and is recording a temperature of -18°C and a pressure of 93.5 kPa. What is the volume of Emil’s ssswballoon at this point?

*Use the Combined Gas law equation*

*P1 V1/T1 = P2V2/T2*

*Convert from Celsius to Kelvin:*

*T1 = Tc + 273.15*

*T1 = 16°C = 273.15*

*T1 = 289.15 K*

*T2 = Tc + 273.15*

*T2 = -18°C +273.15*

*T2 = 255.15 K*

*100.6 kPa \* 500.0 L / 289.15 K = 93.5 kPa \* V2 / 255.15 K*

*V2 = 474.7 L*

*Therefore the final volume is 474.7 L*

*(3 marks, knowledge)*

I would use this as assessment OF learning. It goes through each of the gas law equations and has more than one question asking for each formula. It would be a great assignment at the end of a unit, or questions for a test.

1. What are the postulates (statements) of the kinetic molecular theory (look back at chapter 11).
2. What is the difference between real and ideal gases? (look at your assigned reading)
3. A real gas will condense to a liquid when the temperature is low enough. Why doesn’t this fact support the kinetic molecular theory as it applies to ideal gases?
4. Yen accurately accumulates acetylene gas at 23 °C and a total ambient pressure of 98.1 kPa using the water displacement method. What is the partial pressure of dry acetylene?
5. Ricky realized that the raunchy aroma was the result of the release of 2.600 g of a volatile organic reagent which contained 0.644 g of carbon and 1.902 g of chlorine. If the compound contains only carbon, chlorine and hydrogen and occupies 730 mL at 98.7 kPa and 50°C. What is the molecular formula of Ricky’s raunchy reagent?
6. Patricia postulated that she could properly compute the molar mass of gas that has a density of 1.71 g/L at a pressure of 97.0 kPa and a temperature of 26.5°C. Help Patricia complete her computation.
7. Calculate the moles of air in a 250 mL beaker. Explain all of the steps you took to do this.